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By-Bush, Robert N.; Gage, N.L.
Center for Research and Development in Teaching.

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The major portion of this report summarizes prior research at the Stanford Center for Research and Development in Teaching within the framework of three domains of variables: the behavioral or directly observable variables; the personological or those inferred from tests; and those institutional variables which affect the social, technological, and administrative areas of teaching. Behavioral studies investigate technical skills, teacher effectiveness, small group instruction, computer assisted instruction, methods of teaching children to recognize alternative answers and inappropriate certitude, and the effects of anxiety on intellectual processes. Studies of the teacher-pupil relationship are made within the personological domain using a photographic pupillometer, factor analysis, and other devices to test pupil interest and cognitive preference. Studies in the institutional domain involve the organizational context of teaching, the professional socialization of teachers, and teachers' attitudes toward innovation. Present and future work is based on three problem areas--heuristic teaching (developing self-motivated and sustained inquiry, emphasizing affective as well as cognitive processes, and placing a high value upon the uniqueness of each pupil, teacher, and learning situation), teaching environment, and teaching the disadvantaged--which are extensions of previous research. The report also describes service operations which contribute directly to research. A 63-item bibliography is included. (SM)

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CENTER FOR RESEARCH AND DEVELOPMENT FOR TEACHING

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CENTER FOR RESEARCH AND DEVELOPMENT IN TEACHING

Robert N. Bush and N. L. Gage
Stanford University

The Stanford Center for Research and Development in Teaching began its work in September 1965. A part of the School of Education, it provided a new setting for collaboration among professional educators and behavioral scientists. Its aim, as stated in the original proposal, is "to improve teaching in American schools."

The Center's Evolving Goals

In this effort, we distinguish between *teacher effects* and *teacher education.* Teacher effects refer to relationships between teacher behaviors and characteristics (independent variables) and pupils' achievement and changes (dependent variables). Teacher education refers to relationships between teacher behaviors and characteristics (dependent variables) and teacher education programs and procedures (independent variables).

Using the above distinction, the Center originally grouped its research efforts in three "domains" of variables: the *behavioral,* the *personological,* and the *institutional.* These terms denote events that occur at increasing "distances" from the point of impact of the teacher on his students in the classroom. The *behavioral* domain refers to those variables which deal with the observable, objectively describable behaviors of teachers and pupils in the classroom. *Personological* variables are traits and characteristics of teachers and pupils, not directly observable in the classroom but rather inferred from responses to tests, inventories, and rating scales. Teachers' attitudes, values, cognitive abilities and styles, traits, and characteristics are all variables in the personological domain.

The Center has been concerned with how the role of the teacher is being affected by social and technological changes and by the social and administrative forces in the school district and the individual school. These changes and

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forces constitute the *institutional* domain. The Center has examined the organizational context of teaching, the professional socialization of the teacher, and other aspects of the institutional setting.

During the academic year 1967-68 the Center reformulated its programs and goals. Three major problem areas were defined, stemming in part from previous research of the Center. The first problem area, *heuristic teaching,* reflected an urgent demand for more effective and informed teaching and a more precise definition of the teacher's role in the context of social and technological change. We see heuristic teaching as teaching aimed at developing self-motivated and sustained inquiry, emphasizing affective as well as cognitive processes, and placing a high value upon the uniqueness of each pupil, teacher, and learning situation. It is contrasted with didactic teaching, in which the teacher dispenses information to passive pupils. The term "heuristic" connotes only a part of what we see emerging, but we have not yet been able to find a better single term for the cluster of questions we wish to investigate.

The second problem area, *the environment for teaching,* derives from our conviction that schools must be so organized and operated as to permit a new kind of teaching and learning to take place. Schools as now organized tend to discourage the kind of teaching and learning we have called heuristic. We are asking how the learning environment can be modified in the direction of the "open" school, defined later in this paper.

The third problem area, *teaching the disadvantaged,* arises from the urgent needs of the poor of our cities and certain minority groups. It would be foolish to blame the schools alone for these problems or to expect them alone to reduce their severity. But the Center's program in this problem area will seek to determine how the concept of heuristic teaching, applied in the environment we call the open school, can help contribute to overall solutions.

Research Efforts at the Stanford Center

The scope of the Center's research is perhaps best shown by describing individual projects and investigations within the framework of the domains and problem areas sketched above. The following account summarizes the Center's past, present, and future as of July 1968.

The Behavioral Domain

1. *An Overview of Research on Teaching*

An obvious need in the early stages of the Center was a survey of current literature which might have relevance for the Center's researchers. The resulting paper (Gage & Unruh, 1967) dealt with the proposed revolution in teaching ("describing" vs. "improving" in research on teaching; two convergences on conceptions of teaching), models of the domain of research on teaching, the relation of theories of teaching to theories of learning, the need for synthesis, and views on promising directions in research on teaching.

2. *Studies of Microteaching, and Training in Technical Skills of Teaching*

Microteaching grew out of a technique being developed at Stanford when the Center began. It is a scaled-down teaching exercise, wherein the trainee teaches a lesson of about five minutes to a small group of pupils, typically about five in number, and attempts only a relatively specific aspect of the teacher's task, such

as making an assignment, using a visual aid, handling a discipline problem, or engendering a cognitive set. Microteaching is "real" teaching in that the pupils are not actors and do not hear the same lesson twice. After the trainee has taught the lesson, he views a videotape recording of his behavior which he discusses with a supervisor trained to make helpful and tactful suggestions. Then the trainee immediately reteaches the same lesson to a different group of pupils and also repeats the cycle of discussion and criticism while observing the new videotape recording. The technique has been used extensively with students preparing for internship at the secondary school level in the teacher education program of the Stanford School of Education.

One key aspect of microteaching—the selection of a small, identifiable, specific sequence of teaching behavior—led to a more general concept: "technical skills" in teaching, or specific teaching behaviors that are used in a variety of teaching situations and are to some degree independent of the subject matter or the kinds of students being taught.

The long term goal of the Technical Skills project has been to define a set of skills making for effective teaching; to determine the effects of these teaching behaviors; and to determine how to train teachers to use these skills. The dependent variables are thus the specific technical skills desired; the independent variables are training procedures, such as modeling and feedback.

Implicit in this research is a certain conception of teaching style. We have been most interested in those behaviors least likely to be reproducible by non-human means such as texts, films, television, and computers. We see the teacher as a stimulator of inquiry and a guide of self-directed activity. This concept of teaching will be recognized as part of what we have termed "heuristic" teaching.

The research has been carried out in connection with the secondary teacher education program at Stanford; the interns in this program thus serve as "subjects" both for the experimental studies of technical skills and for studies aimed at improving or modifying the teacher-training program at Stanford. Three broad categories of variables have been manipulated: (a) the *demonstration* component of teacher training (various kinds of instructions or performance models); (b) the *conditions of practice* (variations in the amount and timing of interns' practice and in the choice of lessons); and (c) *feedback arrangements* (viewing of videotapes of teaching performance, with variations in the cues by which the subject is helped to analyze his behavior).

Following are some of the hypotheses or conclusions which have emerged from the technical skills work:

1. For initial learning of a complex teaching performance, where the trainee teaches the same lesson as the model, a preferred strategy is to show a model performing the desired behavior, but with no non-instances of the behavior in the model tape. A second learning trial, using both instances and non-instances of the desired behavior, then introduces discrimination training.
2. Students who first taught one lesson and then taught a different lesson showed a marked decrease in performance.
3. Two training conditions were found to be particularly effective: (a) a combination of perceptual modeling (videotaped model of a teacher performance), positive instances only, followed by teaching the *same* lesson as

that demonstrated; (b) symbolic modeling (written description of a lesson) with instances and non-instances of the desired behavior, followed by trainee's teaching his *own* lesson.

4. In the development of "inquiry questioning," models of pupil responses to teacher behavior were more likely to be effective than models of teaching behavior.

5. A general hypothesis emerging from the technical skills research is that negative instances or non-instances of the desired behavior are effective only when they can be used in a discrimination-training strategy. These results seem to accord with a body of psychological literature that encourages instructors to avoid inducing learning by indirect means, except when such learning can be linked to ways of finding the patterns of the behavior to be learned.

6. If the trainee, while viewing a videotape of his performance, is systematically cued to look for specific kinds of behavior to be learned, his learning is likely to be improved. But cueing during a feedback session (as distinct from a modeling session) added nothing to the improvement in performance. This experiment leads to the hypothesis that when effective cueing can be provided during a *modeling* session, it is not necessary to add the cueing component to the *feedback* session.

Two related investigations, whose data have not yet been fully analyzed, deal with the interaction between training-method and the technical skill being learned. An experiment at Stanford used three types of training conditions: (a) symbolic modeling (transcript of a lesson); (b) perceptual modeling (videotape of the same lesson); (c) a brief written description, which the trainees read, followed by their own teaching and subsequently by feedback with an experimenter present to analyze their teaching performance. Three different technical skills (reinforcing students for participating in class discussions, probing, and the use of silence and non-verbal cues to stimulate discussion) were learned on three successive days. An experiment at San Jose State College, with elementary school interns, applied two treatments (modeling with and without an experimenter present) to the learning of the three skills just cited. The effectiveness of the treatments will thus be tested across the learning of three different skills.

Trainees in the above experiments have exhibited differential reactions to treatment, such as positive and negative emotional reactions. They have also seemed to demonstrate different cognitive strategies and capacities as they viewed model or feedback videotapes. Studies are under way to determine how such characteristics interact with kinds of treatment by investigating possible relationships between trainees' scores on perceptual and verbal ability measures and the kinds of models (perceptual or symbolic) presented. This line of inquiry is related to the aptitude-treatment interaction studies described below under Heuristic Teaching.

An important element in the project has been the attempt to follow up the training program by examination of the trainees' behavior after a full year of teaching. Videotapes of microteaching sessions at the beginning and end of the Stanford secondary interns' summer 1967 training period, and at the end of their full year's teaching in 1968, have been combined with test data and are being examined to discover possible effects of the Technical Skills project.

An interesting extension of microteaching and the technical skills approach

is called "learner-monitored teaching." Equipment providing for immediate audio and visual feedback in various possible combinations during a teaching session has been designed and in part constructed. Through a master control station and learner satellite stations, the teacher-subject may receive predetermined comments or specific inquiries and reactions from both pupils and observers.

The Technical Skills project has resulted in production of a 30-minute color film, "The Technical Skills of Teaching," in which the concept is explained and demonstrated.

Papers resulting in whole or in part from the project include McDonald (1968a and 1968b), McDonald & Allen (1967), and Orme (1967).

The Technical Skills project will continue as a project on Training Studies within the new problem area of Heuristic Teaching. Further investigations will concentrate on the technical skills which are or seem to be directly related to eliciting complex, inquiry-oriented pupil behavior.

3. *Technical Skills of Teaching: Explaining*

The "effectiveness" of teachers in presenting explanations or lectures to their classes has been an area of investigation. This project was based on the assumption that the explaining aspect of the teacher's role will continue to have some significance despite the increased use of various media other than the teacher (television, programmed instruction, films, and the like) for didactic instruction.

Four studies, based on the same set of data, were completed and described in a symposium on "The Teacher's Explaining Behavior" at the February 1968 AERA meeting. The first study (Belgard, Gage, & Rosenshine, 1968) indicates that the teacher's ability to explain does not depend entirely upon the particular lesson being taught on a particular day to a particular group of students, and that students' ratings of various dimensions of their teacher's performance correlate substantially with how much they learn from that performance. Unruh (1968) found that videotaped lectures provided more valid cues than typewritten transcripts, transcripts combined with videotapes, audiotapes, or both, or audiotapes and videotapes combined. The most important correlates of effectiveness, as measured by adjusted mean comprehension scores, appeared to be student-rated teacher preparation and presentation, the cognitive level of the presentation, use of an outline, and coverage of the material. Responses relating to personality variables and vocal quality did not discriminate. These results should be useful in the search for less subjective and perceptual, and therefore more objective and behavioral, correlates of effectiveness.

Rosenshine (1968) found four of 72 variables which discriminated between high- and low-scoring teachers, as measured by their students' adjusted mean achievement scores. These were (a) rule-example-rule-pattern, (b) explaining links, (c) gesture, and (d) movement. Dell & Hiller (1968) used a computer to count kinds of words appearing in the transcribed protocols of the teachers' explanations. High negative correlations between "vagueness" (words such as *almost, generally, many, maybe,* and *most)* and effectiveness were found. Explaining links correlated .37 and .38 with effectiveness.

To the extent that lecturing or verbal exposition forms part of any classroom situation, the above findings should have relevance in determining the kind of explaining behavior found most effective.

∴ Abstracts (author) appear in AERA Abstracts of meetings, 1968

4. *Role-Playing in Teaching Decision-Making Skills*

The impact of role-playing on the cognitive and affective life of the learner, and its implications for teacher training techniques, have been an area of investigation. The data have been collected and are being analyzed. Meanwhile, a training seminar in role-playing is being conducted with a group of secondary interns, and documentary and training films have been made.

Further work will be carried on in the new program on Teaching the Disadvantaged described below.

5. *Teaching in Small Groups*

An early assumption by the Center was that interpersonal relationships, and specifically working with pupils in small groups, will play an increasingly important part in the definition of the teacher's role. Three lines of inquiry have been followed.

An experimental training program at Stanford for a group of 26 secondary English and social studies teachers was one line of inquiry. Follow-through was provided by verbal reports on the teachers' perceptions of the small group classes they themselves conducted the following fall and by videotape recordings made in the classes of teachers who had and had not participated in the workshop.

Experimental training programs with Stanford interns have provided the means of investigating the kinds of learning experiences within a conventional class (lectures, discussions, reading, and reflective writing) and in a "human relations" approach to teacher training. Data reduction and analysis are in process.

An experimental course using a laboratory approach, focusing on the classroom as a group with its own norms, values, and status systems, was developed. The subject matter of the course thus examined the behavior of its students as well as the "established knowledge" about teacher-student classroom interaction. The course was designed to be self-evaluating; in analyzing the data, the students learned something about empirical evidence as well as group life in a classroom situation.

Small group research will continue within the new Heuristic Teaching program and later in the program on Teaching the Disadvantaged.

6. *Teaching for Divergent Thinking (Effects of Computer-Assisted Instruction)*

The effects of computer-assisted instruction have been of interest to investigators concerned with teaching for divergent thinking. A study of first graders receiving reading and mathematics instruction by CAI and by conventional instruction was conducted. (Sears & Feldman, 1968). The results showed a significant effect from fall to spring; the CAI group started higher than the non-CAI in social behavior scores but declined, while the non-CAI group increased over the year in social behavior scores. The relationships between IQ, reading, and mathematics achievement test scores, and achievement as measured by a standardized test and by progress on the computer differed in interesting ways for the classroom and CAI groups. Normally, one expects achievement and academic variables to be correlated. The CAI treatment, designed to individualize instruction, appears to have reduced these relationships.

7. *A Taxonomy of Teaching Behavior*

A pool of items designed to serve as a behavior-descriptive system was developed

and categorized. The initial pool was based on a review of existing observational instruments; additional items were written to fill in gaps. A computer-based system was developed to facilitate the use of the item pool. A category generator program is used to structure the entire pool or subsets of the pool according to any category system supplied by the investigator. A rating form generator program is used to prepare rating forms for the supervisors of the Secondary Teacher Education Program.

The system will be utilized in connection with the Intern Data Bank (described later in this report) and other research as it is relevant.

8. *Photography of Attending Behavior*

Time-lapse 35mm photography has been used to collect and analyze data on the attending behavior of students in their classrooms. Filmstrips of intern teachers and their classes have been developed. Rank-difference correlations among three measures of attention in nine classes were identified.

9. *Uncertainty Studies*

There are theoretical grounds for believing that uncertainty—the recognition of ambiguity or of alternative goals and solutions—and "uncertainty behaviors" underlie inquiry-oriented thinking and other complex cognitive processes. An early study indicated that lower-class children (grades 1, 2, 4, and 6) had difficulty both in generating and in using constructive alternative solutions to problems, and that an apparent increase in curiosity at the second-grade level did not continue to develop.

Children are often inappropriately certain of their answers; the expression "secondary ignorance" was coined to denote this phenomenon of one's not knowing that he does not know. Ways of teaching children to recognize when alternative answers exist have been investigated and reported. (Sieber, 1968b) One aim of this project is to improve understanding of the ways in which secondary ignorance, or inappropriate certitude, is typically expressed in various contexts, and to provide teachers with examples of inappropriate certitude and methods of teaching students to generate and handle "subjective response uncertainty."

This research line will be continued in the program on Heuristic Teaching, with obvious implications for the program on Teaching the Disadvantaged. New lines of inquiry are described later in this report.

10. *Effects of Anxiety Upon Intellectual Processes*

In a project on the determinants of complex information-processing behaviors in children, the relation between anxiety level and failures in problem-solving strategies in fifth- and sixth-graders has been investigated (Sieber & Kameya, 1967; Sieber, 1968c). Two forms of experimental intervention to reduce anxiety or encourage its facilitating effects were tried: (a) provision of memory support, and (b) brief training programs designed to reinforce attention to problem-relevant stimuli and to stimulate encoding and evaluation of such information. Preliminary results on the memory-support portion of the experiment suggest that the interference of anxiety with short-term memory could be offset by a variety of external aids such as diagrams or notational systems which problem-solvers could be taught to use. Further research includes a study of the effects of anxiety, IQ, and task difficulty on concept formation with

and without memory support.

11. *Computer-Assisted Instruction in Teacher Education*

Ways of using computer-assisted instruction (CAI) in teacher education have been investigated. In instruction on a statistical procedure for processing test scores of students, a classroom group scored higher (though not significantly) on a criterion test than did the computer group. A group which proceeded through the program in a standard, linear manner scored higher (again, not significantly) on a criterion test than did a group allowed to make greater use of the flexible, branching capabilities of the computer.

The projects described above deal with behavioral variables having general application in the teaching process. The following two projects have concerned themselves with the development of technical skills as they apply to the teaching of specific subject-matter areas.

12. *Technical Skills of Teaching: Foreign Languages*

This project aims at improving the training of foreign language teachers by (a) producing materials and programs to train, and instruments to evaluate, foreign language teachers, and (b) studying characteristic classroom behaviors of good and poor language teachers identified in terms of their effects on pupils.

Three publications have been produced (Politzer, 1966a, 1966b; Politzer & Bartley, 1967). The procedures outlined in these publications were based on the general research in microteaching and modeling. The subsequent phase of the project establishes the reliability of the rating instruments and, above all, their validity in terms of the study of the effects of teachers on pupil attitude and achievement.

A pilot study dealing with the change of pupil attitudes yielded the somewhat disturbing result that teachers rated high in the performance of certain skills tended to have a negative effect on pupil attitude toward the subject (Politzer, 1967).

In the basic study, videotapes were made of 15-minute segments of the teaching performance of a group of French teachers. Criterion measures of speaking, listening, and writing in French were later administered to all pupils. An instrument for rating teacher-student interactions was developed and applied. Preliminary results indicate that teachers whose pupils were on the whole more successful (as measured by achievement) showed a significantly higher proportion of relatively uncontrolled to strictly controlled classroom interaction than did the teachers of the less successful pupils.

Work on foreign language teaching will continue under the new focus of the Center, concentrating on the problem of teaching the disadvantaged. The research will investigate the problems of transferring experience gained in teaching a second language to the teaching of the "second dialect" represented by the language used in and beyond the school.

13. *Technical Skills of Teaching: Social Studies*

This project investigated use of videotapes in conjunction with a course in social studies teaching methods. A Social Studies Teacher Appraisal Guide was developed. Copies of some of the videotapes have been prepared for local school systems and for the staff college of the U. S. Army Civil Defense School. The project has been described at meetings of social studies leaders and teacher educators and

in articles for educational journals.

The Personological Domain

1. *Teachers' Attitudes and Their Correlates*

An early Center project was aimed at developing methods for determining causal relationships between teachers' attitudes towards pupils and pupils' attitudes towards their teachers (Yee & Gage, 1967). A second project, a study by means of diagonal factor analysis of a 100-item inventory of pupils' perceptions of their teacher, was aimed at determining whether five a priori categories of teacher merit (cognitive, affective, disciplinary, motivational, and innovative) would be supported empirically (Zwirner, Beck, Cronbach, & Gage, "Pupil Perceptions of Teachers': a Factor Analysis of 'About my Teacher," tentatively titled and in preparation). A further study investigates relationships between scores on the a Factor Analysis of "About my Teacher" tentatively titled and in preparation). A further study investigates relationships between scores on the California F Scale and Kerlinger's Educational Scale 7 and teaching interns' use of inquiring questions in the classroom in the early stages of their teaching.

The Center has developed a collection of research instruments for the measurement of teacher personality and characteristics. A 300-item Educational Opinion Inventory was administered to some 160 Stanford interns, and will be factor analyzed. Further work on the validation of teacher personality and characteristics against classroom behavior is being carried out.

2. *Teachers' and Students' Cognitive Preferences in Mathematics*

Recent research has given much attention to the existence of "cognitive styles." A Cognitive Preference Inventory was developed to identify possible differences in cognitive preferences of both teachers and learners, and their possible interactive relations (Travers, Heath, & Cahen, 1967). In this instrument each of 30 mathematics concepts is expressed in three different ways: verbal, symbolic, and graphic. One study indicated that both teachers and students of mathematics most often preferred the symbolic option. A further study presently under way will have as independent variables teaching mode, the verbal-symbolic-graphic distinction, and the student's preference for mode of mathematical expression, with pupil achievement as the dependent variable.

3. *Pupillometry in the Study of Teacher Attitudes*

Recent findings suggest that interesting visual stimuli and mental activity in arithmetic problem-solving produce pupillary dilatation. Research at the Center is intended to apply this finding to education.

A photographic pupillometer was designed and completed. Certain theoretical issues involving the nature of the visual stimulus presentation were developed. Techniques for scoring and analyzing pupillometric data were incorporated into two computer programs using inputs from the high speed optical scanning of photographic film. A detailed survey of the literature is nearly completed. Several pilot studies were made and are in the last stages of data analysis. One study was presented at the 1968 AERA meeting (Koff & Hawkes, 1968b). Other reports are in preparation.

The project has collaborated with Center and Stanford staff in several other areas of research. A study of "Structural and Interpersonal Components of Teaching Style: a Study in Pupillary Response" has been made; the analysis of the data is nearly completed.

The difficulty of measuring and controlling for a wide variety of compounding effects means that much additional basic research is necessary before the generalization can be made that change in pupil diameter indicates interest, attention, or cognitive complexity.

The Institutional Domain

1. *The Organizational Context of Teaching*

In an effort to identify organizational elements which influence the decision-making behavior of classroom teachers, extensive interview and questionnaire data from 16 elementary and 16 secondary school teachers, drawn equally from conventional and modified schools and from first-year and experienced teachers, were collected and analyzed. Tentative conclusions, which will be useful in further research, are summarized in the Center's First Annual Report (1967).

Another study dealt with the problem-solving efficiency and style of teaching teams organized with and without designated leaders. The teams were asked to solve the same two problems under standardized directions and time limits. The work sessions of each of these groups were recorded on audio tape. Additional information was gathered from each teaching team on its members' perceptions of the way in which they carried on their team work, attitudes toward their team experience, and preferences for assignment in the next school year. The data are undergoing final analysis. A second phase of this project will compare the decision-making efficiency of teaching teams with that of individual teachers.

2. *The Professional Socialization of the Teacher*

This project aims to identify and examine factors that affect role expectation and commitment in teaching and influence career mobility. Questionnaires were administered to one school district's approximately 1200 teachers; a modified version was administered to administrative and counseling personnel in mid-year. In analyzing the data, the project staff will look for changes in the attitudes and expectations (with particular emphasis on the perceived characteristics of the successful teacher and on role definition and expectations) of inexperienced and experienced teachers and of administrative and counseling personnel.

Further work on professional socialization of the teacher is described in the section on Environment for Teaching.

3. *Occupational Attitudes of Teachers*

The purpose of this project is to investigate the formation of occupational attitudes among teachers, their relation to dominant social values, and the consequences of group differences in such attitudes. Pretesting has been completed on a 60-item scale with the following occupational attitude dimensions: conformity, creativity, social contributions, financial reward, status, and security. The items are currently being revised.

4. *Case Studies of Teachers in Open and Closed Schools*

Innovations in structural arrangements,

teaching responsibilities, scheduling provisions, and pupils' class assignments are widely considered to make school experience more meaningful for teachers and pupils. Evidence is being accumulated about teacher behaviors that are modified by such innovations and those that are not. The data gathering began with a case study of a school with a traditional structure and organization. Particular emphasis has been given to the teachers' patterns of interaction with others, with teaching seen as a series of social encounters whose significance varies according to the activity base of the encounter, the population involved, and the physical setting.

In the 1968-69 year, the project will expand the study to include a more innovative, or "open," school. If possible, the study of the original traditional school will be continued to take advantage of a forthcoming shift in its pupil population and socio-economic background.

5. *The Teacher in 1980*

An early concern of the Center was a broad study of the future role of the teacher, in the course of which extensive interviews, seminars, and panel discussions on the topic were conducted. A thorough review of the subject will appear as a research memorandum.

It has become clear that the entire orientation of the Center is toward determining the role of the teacher in a period of heightened social and technological change. Accordingly, "The Teacher in 1980" has been terminated as a separate project.

Heuristic Teaching

We turn now to consider the work being conducted under the Center's new problem-area focus. Much of this work is a logical extension of projects begun under the previous formulation and has been described earlier in this report. Here we attempt to complete our description of the present status of the Center's research and development on the crucial problem of heuristic teaching.

1. *Training Studies*

Research on the technical skills of teaching is continuing, with emphasis on the skills most directly related to eliciting complex, inquiry-oriented pupil behavior. Modeling and feedback variables will continue to be manipulated. The new research will emphasize training in combinations of skills; pupils' question-asking as a function of the teacher's modeling and reinforcement; and pupils' question-asking over a series of lessons.

2. *Aptitude-Treatment Interaction in Heuristic Teaching*

One of the Affiliated Projects of the Center has been a study of interactions between aptitudes and instructional treatment variables. Included as "aptitudes" are characteristics and styles of both teachers and learners. The teacher's characteristics and styles of teaching can be investigated both as aptitudes with respect to teacher training programs and as treatment variables that interact with student characteristics and styles of learning (aptitudes) in producing student achievement.

Two studies, with particular implications for heuristic teaching, will be conducted. The first of these will examine extemporaneous and heuristic aspects of teaching and learning in closely controlled teacher-pupil dialogue situations, so that important stylistic variables can be defined and related to other aptitudes of

teachers and learners. A second study will investigate interactions in complete classrooms. Evidence from earlier studies indicates that the correlations between student aptitudes and student achievement may vary systematically according to the characteristics and styles of their teachers. Such relationships cannot be elucidated from the measures of *average* class achievement. This second study will seek to identify positive and negative correlations between teacher aptitudes and treatments and student aptitudes and achievements. It is hoped that these and other studies will elaborate a more differentiated view of teacher training and teacher roles and will suggest additional teaching skill variables for development.

3. *Uncertainty Studies*

Preliminary research and theorizing has identified a number of cognitive skills which underlie learning to avoid premature judgments and to make correct use of available, although often disorganized, information. Ways of teaching these behaviors will be investigated.

A first and exploratory study will examine the degree to which uncertainty behaviors are found in lower-middle-class fifth-grade children and the extent to which these behaviors can be taught to such children. A second will be a two-year experiment adding new variables and covering grades 1, 4, 8, and 12 in middle- and lower-class schools. A third study will deal with the acquisition and use of uncertainty skill by teaching interns.

In recent research, preliminary results indicate that accuracy of estimation of subjective response uncertainty is a generalized trait across tasks and is uncorrelated with divergent thinking ability. Another study found a significant interaction of task structure and task definition in producing differences in subjective response uncertainty. While nonstructured films were found to increase subjective response uncertainty under instructions to generate diverse hypotheses, structured films were superior in production of response uncertainty under cue-attendance instructions. A "surprisal" measure of the information value of a particular response or group of responses was devised; this measure was used in a study which confirmed the interaction between stimulus structure and learning task.

4. *Experiments on Heuristic Behaviors in Disadvantaged Children*

Three experimental studies with disadvantaged children are in process. One study will examine the assumption that middle-class children are rewarded for and readily learn task persistence, while minority youth are impulsive in a way that interferes with it. If such a difference is found, it may be important to seek to improve persistence. The study will assess the effects of self-reinforcement on task persistence, the relation of expectancy of success to self-reinforcement, and the effects of task persistence itself on achievement. A second study will test the effects of modeling treatments on a child's learning to admit the existence of ambiguity. Lower-class children will observe models of other children expressing doubt in ambiguous problem-solving situations. The effects of being exposed to these models, presented on videotape, will be tested. A third study stems from the hypothesis that many minority-group children respond impulsively partly because of their relatively poor information-processing capacities and are rewarded for over simplification of discriminative perceptual and cognitive processes. Variables will be manipulated to see if such children

can be helped to learn to control their impulsivity by teaching careful cue discrimination, or by simply increasing the amount of contingent reinforcement received.

5. *Small Group Research*

Exploratory studies in the training of interns are in process. A first study will examine the extent to which a type of social interaction training improves the conduct of effective group activity and heuristic teaching styles in classrooms. A second study will assess how an inquiry-oriented, as contrasted to a sensitivity-oriented, group process can be used to help interns to learn heuristic teaching styles.

6. *Heuristic Teaching and the Teacher's Sense of Personal Competence*

Beginning teachers' concern with their own personal adequacy and competence may reduce their effectiveness in the classroom. To be studied is the influence of feelings of personal inadequacy, conceptions of one's self, and actual classroom experience on the way intern teachers think about themselves in the teaching process. A basic assumption is that heuristic teaching, with its emphasis on inquiry and challenge, will be anxiety-provoking and thus aversive for many teachers and may also produce resistance and anxiety in students. The study will determine which types of teachers are more responsive to specific sequences of treatment techniques in reducing excessive anxiety. If feasible, the study will also investigate methods of modeling inquiry behavior for students. Part of the study will attempt to develop methods for training counselors to advise teachers faced with inquiry-oriented students. It is hoped that physiological telemetry can be added to the measurements in the study.

The Environment for Teaching

Teaching today is shaped by crisis and change—the crisis of a school experience that is dysfunctional for too many of the nation's children and youth, and change as a consequence of organizational and technological innovation. The environment we believe to be most necessary for effective teaching is one that we call the "open" school. We see the open school as displaying high organizational flexibility. Such a school is characterized by a differentiated staffing plan, flexible scheduling, collegial evaluation of faculty, provision for further career development, and arrangements for genuine collaboration with the community or neighborhood it serves. Much of the Center's research efforts in this problem area will concentrate on variables that affect these characteristics. The projects described below will be conducted by current members of the Center's staff and by new members from the Department of Sociology and the Graduate School of Business.

1. *Professional Socialization of the Teacher and His Career Development*

In 1967-68 this project focused on how the socialization effects of the first year of teaching affect the beginning teacher's sense of autonomy and his definition of the successful teacher. The project will now deal with the formal and informal process of "inducting" the beginning teacher and "resocializing" the experienced teacher who changes school systems. The project will seek to describe the process more adequately, to assess its impact on teacher behavior with more certainty, and to estimate the most prob-

able outcomes, in terms of teacher behaviors, of specific ways of alleviating the beginner's initial fear of teaching and the experienced teacher's problems in his first year in a new school system. A part of the project is a study of the ways in which new teachers achieve autonomy within the school organization. We are particularly interested in the above processes as they affect open schools.

2. *Innovative Organization and Innovations in Teaching*

Whether, and how, educational innovation is introduced into a school is affected by the nature of that school's organization. To be conducted is a rigorous field study employing a highly structured and extensive interview technique to explore a wide range of propositions and theories about the process of organizational change in schools. These include the characteristics of the change agent, innovation as a decision process, the receptivity of a social environment to change, and financial resource allocation as an instrument of change. The information obtained will represent an important step toward a more comprehensive and accurate description of the innovation process. The ultimate goal of the project will be to generate a set of procedures or innovation plans that can be used as guidelines for introducing change in materials and creating open schools.

3. *The Teacher in the Authority Structure*

Six members of the Stanford Department of Sociology have formulated an extensive and integrated research program bringing certain sociological concepts to bear on the questions of educational organization and the school context of teaching. The theoretical basis for much of the investigation will be the concept of authority systems in formal organizations developed at Stanford. Authority systems are analyzed in terms of the process by which the performance of organizational participants is evaluated and organizational rewards and punishments are distributed. This concept has been successfully applied to five organizations in the United States and two in Nigeria. Within this frame of reference, the team will study patterns of evaluation and authority in schools, the role of the professional teacher in a bureaucratic organization (the school), and the status orientation of teachers as it relates to their professional behavior. Additional lines of inquiry will examine the social context of teacher-student relations, particularly with respect to students' educational and occupational aspirations.

Teaching the Disadvantaged

The disadvantaged student tends to reject the conventional educational system, first by failing to achieve its curricular objectives and ultimately by dropping out of it. His parents and community tend to regard the present system as merely another bureaucracy which they have little power to influence.

We believe that research and development on the education of the economically disadvantaged must *itself* become involved in the socio-psychological setting of the schools. Parents, community groups, and teachers must become participants in, rather than objects of, the design of education.

The teachers are the primary objects of our concern. The present-day teacher is often remote from the cultural life of the disadvantaged child, unable to influence decisions about the curriculum he attempts to translate to the child, and

inadequately supported by training and resources to overcome the barriers separating the disadvantaged pupil from relevant educational experiences.

The Center's new program attempts to concentrate a portion of available resources on the problems of teaching the disadvantaged, making use of the experience and skills peculiar to this Center.

1. *A Community-Centered Teaching Laboratory*

The Center proposes to try out a means for entering an economically deprived community to conduct basic research and development on the teaching processes. The aims of the approach are to develop teaching programs that are meaningful to students, to engage parents and local community leaders in this process, and to develop ways of training and retraining teachers of the disadvantaged.

As an intervention strategy, the Center proposes to establish a Community-Centered Teaching Laboratory, located in the community to be served. The Teaching Laboratory can serve both as a laboratory and as a field station within the community. It would maintain close relations with the schools, but would also serve to link community life, concerns of parents, existing formal institutions and agencies, and teaching in the school. The Laboratory would serve for a period of two or three years, and might well then be phased out as an operating entity. The tested programs developed within the program could then be instituted in the schools of the community.

Arrangements for the Laboratory have been made with the elementary school system in an economically deprived community. The precise functions and strategies of the Laboratory will be developed as the community itself begins to define its own educational problems.

2. *A Diagnostic and Developmental Field Study*

Professionals attempting to introduce changes often fail to consider the feelings, thoughts, and attitudes of the participants in the teaching system. Efforts to involve the system's participants have in the past seemed time-consuming and unproductive. Yet it is impossible to ignore participant involvement in the education of the economically disadvantaged child.

A pertinent study in a high school system serving both high income and economically depressed areas will identify four groups of informants, representing students, parents, teachers, and administrators. These informant groups, meeting separately in taped "brainstorming" sessions, will identify problems that they know about. A variety of techniques will be used to establish how each particular group sees the problem, and how they identify the forces contributing to the problem and ways of changing these forces.

At this point, four mixed groups made up of participants from each of the four original groups would begin planning for change. These groups would attempt to reach an agreement on problems posed and develop position papers to be sent to the total group. Finally, the recommendations of each group would be presented to the entire body of persons working on the problem.

3. *The Use of Small Groups to Improve Academic Competence and Self-Respect in Academically Disadvantaged Children*

To be conducted is a study aimed at helping "failures" and problem students

become more effective by using the strong interpersonal forces that can be developed within carefully composed and directed small groups. Such students are assumed to have a variety of assessable aptitudes. Such assessment will serve as a basis for carefully composing small groups to serve as adaptive milieux. Students in these groups will be told that their primary function is to learn skills that will enable them to tutor younger children. Appropriate tasks, questions, and objectives will be established. The plan calls for minimal adult intervention. The work should yield a variety of training and retraining techniques for use by teachers.

4. *A Training Syllabus for Teachers of a Second Dialect*

A new project will undertake development of a syllabus for the teaching of standard English as a second language or dialect. It is assumed that the "first" dialect of the disadvantaged may be another English dialect or even another language, though not usually in its standard form. This project will apply the techniques of second-language teaching which are most appropriate for the special problems of teaching standard English to disadvantaged children.

5. *Procedures and Techniques for Restructuring School-Community-Teacher Relations in Impoverished Areas*

The project aims to improve teaching by using a team—including teachers, an experienced community action specialist, educational researchers, and representatives of the community—to develop and test handbooks, manuals, or other communications materials which will (a) train parents to support the education of their children; (b) show how policy-making school-community committees, parents' clubs, and mutual aid committees can deal with school problems; and (c) provide other aids for both the classroom teacher and participants from the community.

Center Service Operations

The following service functions at the Center are an integral part of its operation and contribute directly to its research.

1. *Microteaching Clinic*

The Center's Microteaching Clinic serves both as a medium of instruction and a vehicle for research. During the summer quarter, beginning teaching interns are trained in the microteaching procedures described earlier. After videotapes of their teaching performances have been analyzed, they are placed in the Intern Data Bank.

2. *Intern Data Bank*

The Intern Data Bank contains data on 170 intern teachers collected at the beginning of their training in June 1967, at the end of the summer period of that training, and again in May 1968 after they had had a year of teaching experience. Other data have been collected and stored on magnetic disks or in other forms. The Data Bank includes data on teaching behavior in 45-minute classes recorded on videotape; pupil achievement in response to that behavior; pupil reaction to the lesson; intern reaction to his own teaching of the lesson; pupil ability; intern ability; and intern attitudes, personality, and life history. These data are being used to assess the effects of training and experience on teaching performance.

3. *Research Methodology Unit*

The general purpose of the Research Methodology Unit is to ensure that the Center's projects use the best possible approaches to problems of design, sampling, measurement, statistical analysis, computation, data processing, and interpretation. Its services are available to all researchers at the Center.

4. *Publications, Dissemination, and Media Unit*

This new unit centralizes the Center's dissemination activities. It is responsible for the Center's publications and reports, editorial services, and library. It also coordinates the activities of the previous units on Film Production and Videotape Service.

Relations With Other Agencies

The Center maintains close relationships with the school districts which have served as sites for its work and with the Far West Regional Laboratory for Educational Research and Development. A productive relationship with San Jose State College is extending the Center's work in research and development on teacher education to the elementary level. The Center maintains close contact with the ERIC Clearinghouse on Educational Media and Technology at Stanford, and with other R&D Centers.

The Outlook

Much has been accomplished during the Center's life thus far; much remains to be done. Many of the problems inherent in organizing, staffing, and administering a complex research organization have been resolved. Specific contributions to our knowledge about, and methods of conducting research on, the teaching process have been developed and widely disseminated. The Center's problem focus has been redefined. We look forward to an intensified effort extending the research and development already initiated and creating new ideas in problem areas as yet unexplored.

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FILMS

Available for distribution:

1. Microteaching: What's That? 1967. Explains microteaching from the perspective of a teaching intern. 30 min., color. Price $200; rental $30.
2. Technical Skills of Teaching. 1968. A master teacher models three technical skills: silence (listening), reinforcement, probing. Commentary by F. J. McDonald. 30 min., color. Price $200; rental $30.
3. Teachers and Classes. Covers classroom discipline situations. 40 min., BW. (Address requests to Stanford University School of Education.)

In process:

1. Role-Playing. On role-playing as a teaching technique in a classroom situation. 20 min., BW.

For research only:

1. Intern Data Bank Storage Films. Thirty-two 40-min. BW films, each recording an intern's teaching behavior.
2. Intern Data Bank Time-Lapse Films. Thirty-two 40-min. BW films on interns' teaching behavior.
3. Math Presentation Mode Stimuli. Thirty-sic 5-min. BW films, showing 12 lessons presented in each of three ways.